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NORTHCENTRAL UNIVERSITY
ASSIGNMENT COVER SHEET

Student: **Michael Higley-Vance**

THIS FORM MUST BE COMPLETELY FILLED IN

Follow these procedures: If requested by your instructor, please include an assignment cover sheet. This will become the first page of your assignment. In addition, your assignment header should include your last name, first initial, course code, dash, and assignment number. This should be left justified, with the page number right justified. For example:

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Save a copy of your assignments: You may need to re-submit an assignment at your instructor's request. Make sure you save your files in accessible location.

Academic integrity: All work submitted in each course must be your own original work. This includes all assignments, exams, term papers, and other projects required by your instructor. Knowingly submitting another person's work as your own, without properly citing the source of the work, is considered plagiarism. This will result in an unsatisfactory grade for the work submitted or for the entire course. It may also result in academic dismissal from the University.

EDU7003-8 **Dr. Rebecca Watts**

Statistics **Activity #3: Probability, Sampling Distributions, and Inference**

Comments: It's getting harder…Youtube videos are helping me out a bunch. HAPPY THANKSGIVING!!! ☺ Yes, they would be helpful. The khan academy would be helpful. Don't forget about those files in the course discussion forum. Let me know if you can't locate them. There is a tab in the courseroom that says "discussion forum." You will find files and folders there that explain the assignments.

Michael, you did very well on this assignment. You explain your reasoning very thoroughly and very well. Your calculations are very good. You are applying the empirical rule and the z-score formula correctly in determining the proportion of scores under the curve of the normal distribution. When you are using samples, you calculate the standard deviation by dividing the

sample standard deviation by the square root of the sample size. You are calculating the probabilities correctly. You did very well. Let me know if you have questions.

Faculty Use Only

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<Faculty Name> <Grade Earned> <Writing Score> <Date Graded>

Data File 3

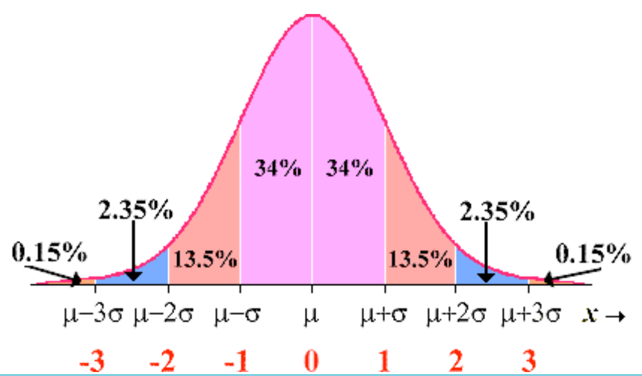
Chapter Five – (show all work)

1) If light bulbs have lives that are normally distributed with a mean of 2500 hours and a standard deviation of 500 hours, what percentage of light bulbs have a life less than 2500 hours? Z-score = (Data value – Mean) ÷ Standard Deviation (SD)

Solution:

Mean = 2500 and SD = 500
2500-2500 = 0
0 ÷ 500 = 0 is the Z-score

Percentage of light bulbs with a life less than 2500 hours is 50% correct



You can either use the empirical rule to deduce that 50% of the scores in a normal distribution will fall to the right of the mean and 50% of the scores will fall to the left of the mean. A normal distribution is symmetrical around the mean. Thus, one side is a mirror image of the other side. 100% or very near 100% of the scores in a distribution will fall under the normal curve between -3 and +3 Standard deviations from the mean. This means that half

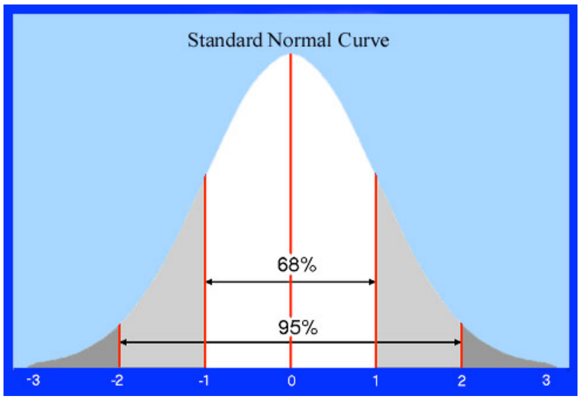
or 50% of the scores are to the left of the mean and 50% of the scores are to the right of the mean.

2) The lifetimes of light bulbs of a particular type are normally distributed with a mean of 370 hours and a standard deviation of 5 hours. What percentage of bulbs has lifetimes that lie within 1 standard deviation of the mean on either side?

Solution: 370 represents the Z-score, which on a bell curve would also represent 0

Mean = 370 and SD = 5
370-5 = 365, which represents the raw score

68% of light bulbs have a lifetime expectancy of at least 360hrs. --very good. Visuals of the normal distribution are very helpful with these problems.



http://www.rogerwimmer.com/researchdr/w4questions.htm

3) The amount of Jen's monthly phone bill is normally distributed with a mean of $60 and a standard deviation of $12. Fill in the blanks:

Solution: 60 – 12 = 48 and 60 + 12 = 72

According to the Empirical Rule, 68% of Jen's phone bills are between $48 & $72 good

4) The amount of Jen's monthly phone bill is normally distributed with a mean of $50 and a standard deviation of $10. Find the 25th percentile.

Solution: Mean = 50, SD = 10
According to the chart provided the 25th percentile z-score = -0.674
X = -.674($10.00) = -6.74 + $50.00 = $43.26 = X

Therefore, 25% of Jen's monthly phone bills will be less than $43.26. good

Problem 4: The 25th percentile corresponds to a z-score of -0.675. Thus, we use the z-score formula: z = raw score (x) - mean (X_{bar})/standard deviation. If we are looking for the raw score that corresponds to the 25th percentile, we are looking for the raw score that corresponds to a z-score of -.675. Thus, we solve the z-score formula for X instead of z: Using a bit of algebra, we find that X = (z * standard deviation) + mean
X = (-.675 * 10) + 50 = -6.75 + 50 = 43.25

5) The diameters of bolts produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. What percentage of bolts will have a diameter greater than 0.32 inches?

Solution: The 68-95-99.7 rule helps determine when data values lay 1, 2, or 3 standard deviations from the mean. The given measurements of the bolts produced by a certain machine are 0.30 inches with a standard deviation of 0.01 inches. The question asks: what percentage of bolts will have a diameter greater than 0.32 inches? 0.32 inches is 0.02 inches more than the mean of 0.30 inches. One standard deviation is equal to 0.01 inch therefore, 0.02 inches is equal to two standard deviations away from 0.30 inches.

Looking at the normal curve chart, the area to the right of 2 standard deviations above the mean is 0.9772. Therefore, the percentage of bolts with a diameter greater than 0.32 inches is: the standard deviation of 1 – 0.9772 = 2.3%. very good reasoning!

2.3% of bolts produced will have a diameter greater than 0.32 inches.

6) The annual precipitation amounts in a certain mountain range are normally distributed with a mean of 88 inches, and a standard deviation of 10 inches. What is the likelihood that the mean annual precipitation during 25 randomly picked years will be less than 90.8 inches?

Solution: The Central Limit Theorem is used to answer questions about the mean score of a group or sample drawn from a much larger population. According to the Central limit Theorem, in this case the random samples for size *n* = 25 years, with a mean precipitation of 88 inches a year, and a standard deviation of 10 inches on a normal distribution.

90.8 – 88 = 2.8 ÷ √10 = 0.28

According to the z-score table 0.28 corresponds to 0.6103 or 61.03% overall. For any random 25 years, 25 × 0.6103 = 15.26

15 years will have rainfall less than 90.8 inches

z = (90.8-88)/(2) = 1.4

From table: 1.4 = .9192

The likelihood is .9192 or **91.9%.**

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Comment [1]: This should be 10/square root of 25

7) A final exam in Statistics has a mean of 73 with a standard deviation of 7.73. Assume that a random sample of 24 students is selected and the mean test score of the sample is computed. What percentage of sample means are less than 70?

Solution:
(70 – 73) = -3 ÷ (7.73 ÷ √24) = 1.58
-3 ÷ 1.58 = -1.899 or -1.9
z score = .0287 × 100 = 2.87% good

2.9% of the sample means are less than 70.

8) A mean score on a standardized test is 50 with a standard deviation of 10. Answer the following
   a. What scores fall between –1 and +1 standard deviation?
   b. What percent of all scores fall between –1 and +1 standard deviation?
   c. What score falls at +2 standard deviations?
   d. What percentage of scores falls between +1 and +2 standard deviations?

Solutions: Mean = 50, SD = 10

A. 50 – 10 = 40 and 50 + 10 = 60 good
Scores of 40 and 60 fall between -1 and +1 standard deviation

B. 34% + 34% = **68% of all scores fall between -1 and +1 standard deviation**
good
C. 2 standard deviations ≣ 10 + 10 = 20 standard deviations therefore, 50 + 20 = 70;
70 represents the score that falls at +2 standard deviations from the mean score
good

D. According to the z score table .9772 - .8413 = .1359 × 100 = 13.59%
13.59% of scores fall between +1 and +2 standard deviations **good**

Chapter Six – (show all work)

1) For the following questions, would the following be considered "significant" if its probability is less than or equal to 0.05? A set of measurements or observations in a statistical study is said to be **statistically significant** if it is unlikely to have happened by chance. P (A) = number of ways A can occur ÷ by the total number of outcomes

   a. Is it "significant" to get a 12 when a pair of dice is rolled?

Solutions:
A 12 can occur if both the dice roll sixes. Each dice has six possible outcomes.
P (6) = 1 ÷ 6. If both dice are rolled the probably of 2 sixes being rolled are:
6 × 6 = 36 and 1 ÷ 36 = 0.0277. Since the probability is 0.0277 or 0.03 and is less

than or equal to 0.05 **the chances of rolling a 12 with two dice is significant**. Good---if the probability level is less than .05, then we conclude that it is significanat.

b. Assume that a study of 500 randomly selected school bus routes showed that 480 arrived on time. Is it "significant" for a school bus to arrive late?

The ratio of late arrivals to all arrivals is: P (late) ÷ P (on time), which translates to 20 ÷ 500 = 0.04. Since 0.04 is less than or equal to 0.05 **a late arriving bus is significant.** **good**

2) If you flip a coin three times, the possible outcomes are HHH, HHT, HTH, HTT, THH, THT, TTH, and TTT. What is the probability of getting at least one head?

Solution: The probability of getting at least one flipped head out of all three flips is 7 out of 8 total attempts: (7 ÷ 8 = 0.875). Therefore, **the probability of getting at least one head is 87.5%.** **good**

3) A sample space consists of 64 separate events that are equally likely. What is the probability of each?

Solution: If 64 events are equally likely, the probability of each is 1 ÷ 64 = 0.0156 or **1.6%.** **good**

4) A bag contains 4 red marbles, 3 blue marbles, and 7 green marbles. If a marble is randomly selected from the bag, what is the probability that it is blue?

Solution: The total number of marbles in the bag is 14. If a single marble is selected from the bag the probability of it being blue is 3 ÷ 14 = 0.2143 or **21.4%.** **good**

5) The data set represents the income levels of the members of a country club. Estimate the probability that a randomly selected member earns at least $98,000.

112,000	126,000	90,000	133,000	94,000
112,000	98,000	82,000	147,000	182,000
86,000	105,000	140,000	94,000	126,000
119,000	98,000	154,000	78,000	119,000

Solution: In the sample above there are 20 members (N = 20) and 14 of them earn at least $98,000.

14 ÷ 20 = 0.7 or 70%. good

The probability that a randomly selected member earns at least $98,000 is 70%.

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6) Suppose you have an extremely unfair coin: The probability of a head is ¼ and the probability of a tail is ¾. If you toss the coin 32 times, how many heads do you expect to see?

Solution: With this unfair coin the probability of seeing heads is one in four flips. If there are 32 throws, I would expect to see 32 ÷ 4 = **8 heads**. good

7) The following table is from the Social Security Actuarial Tables. For each age, it gives the probability of death within one year, the number of living out of an original 100,000 and the additional life expectancy for a person of that age. Determine the following using the table:

a. To what age may a female of age 60 expected to live on the average? To what age is a male of age 70 expected to live on average?

Solutions:

A. According to the graph below a female of age 60, the life expectancy is 23.21 more years or until **83 years old**.

For a male of age 70, the life expectancy is 12.98 more years or until **82 years old**. okay

b. How many 60-year old females on average will be living at age 61? How many 70-year old males on average will be living at age 71?

B. The probability for a female of age 60 to die in the next year is 0.00774. Which means during that year 90,847 × 0.00774 = 703 would die on average. This leaves a total of 90,847 – 703 = **90,144 is the approximation of females living at age 61**. good

The probability for a male of age 70 to die in the next year is 0.0289. This means that during that year 70,214 × 0.0289 = 2,029 would die. This leaves a total of 70,214 – 2,029 = **68,185 is the approximation of males living at age 71**. good

MALES				FEMALES			
Age	P(Death within one year)	Number of Living	Life Expectancy	P(Death within one year)	Number of Living	Life Expectancy	
10	0.000111	99,021	65.13	0.000105	99,217	70.22	
20	0.001287	98,451	55.46	0.000469	98,950	60.40	
30	0.001375	97,113	46.16	0.000627	98,431	50.69	
40	0.002542	95,427	36.88	0.001498	97,513	41.11	
50	0.005696	91,853	28.09	0.003240	95,378	31.91	
60	0.012263	84,692	20.00	0.007740	90,847	23.21	
70	0.028904	70,214	12.98	0.018938	80,583	15.45	
80	0.071687	44,272	7.43	0.049527	594,31	9.00	
90	0.188644	12,862	3.68	0.146696	24,331	4.45	

References

Bennett, J., Briggs, W., & Triola, M. (2013). *Statistical reasoning for everyday life*. (4th ed.) Boston: Pearson Education, Inc.